REMARKS

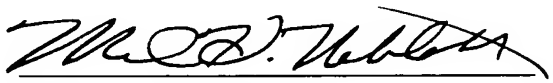
Entry of the amendments to the specification, claims and abstract before examination of the application is respectfully requested. The claims have been amended to conform to U.S. practice.

If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #038724.56178US).

Respectfully submitted,

May 19, 2005



Donald D. Evenson
Registration No. 26,160
Mark H. Neblett
Registration No. 42,028

CROWELL & MORING LLP
Intellectual Property Group
P.O. Box 14300
Washington, DC 20044-4300
Telephone No.: (202) 624-2500
Facsimile No.: (202) 628-8844
DDE:MHN:rde

METHOD AND DEVICE FOR THE REMOVAL OF WATER ICE FROM REFRIGERATION UNITS

~~Description~~

[0001] This application claims the priority of German patent document 102 54 157.4, filed November 20, 2002 (PCT International Application No. PCT/EP2003/012758, filed November 14, 2003), the disclosure of which is expressly incorporated by reference herein.

[0002] BACKGROUND AND SUMMARY OF THE INVENTION

[0003] This invention relates to a method and a device for removing water ice from a refrigeration system for cooling refrigerated goods to a temperature below the freezing point of water.

[0004] It is known that systems for cooling refrigerated goods to a temperature below the freezing point of water, e.g., for freezing foods or pharmaceuticals, i.e., systems having high hygiene requirements, must be cleaned manually during pauses in operation to remove soiling and water ice. However, problems often occur here because it is typically difficult for cleaning personnel to gain access to such systems, which have numerous built-in components in a tight space. Furthermore, it is not desirable to interrupt operations in order to clean, remove water ice and dry out the refrigeration system because this reduces the availability of the system.

[0005] The term "freezing" as used below is also to be understood in the sense of deep freezing and means that the refrigerated goods are exposed to direct or indirect contact with a refrigerant medium at a sufficiently low temperature for a sufficiently long period of time so that following the freezing operation, the frozen goods have a core temperature below the freezing point of water. A core temperature of -18°C is usually reached in deep freezing.

[0006] For example, deep-cold gas (liquefied or gaseous) or deep-cold air is used as the refrigerant medium. Preferably nitrogen or carbon dioxide is used as the deep cold gas. The refrigerant medium picks up heat from the goods to be frozen and thereby cools them. The atmosphere prevailing in the refrigeration system, usually an air atmosphere or less frequently a protective gas atmosphere, is also cooled in the process. The water content of this atmosphere, i.e., the atmospheric humidity, as well as the moisture expelled from the refrigerated goods (e.g., foods or pharmaceuticals) condenses out when the atmosphere is cooled because the ability of the atmosphere to hold water drops with a drop in temperature. Fog is formed. Because of the low temperature, which is desired in a refrigeration system, water ice is formed from the water droplets. An accumulation of water ice on the components of the refrigeration system often will lead to disturbances in operation and have a negative effect on the efficiency of the refrigeration system, e.g., when a layer of water ice adheres to a surface intended for heat exchange. Then the insulating effect of water ice is a disadvantage.

[0007] Even when cooling metal parts to a temperature below the freezing point of water, it is helpful to remove any water ice that may be present from the refrigeration system as this promotes a trouble-free refrigeration process.

[0008] In the case of a continuous system, accumulation of water ice between the moving parts of this system is particularly problematical. Water is traditionally blown off from the moving parts of a continuous system. However, there is the risk here of impurities being introduced into the refrigeration system.

[0009] The object of this invention is therefore to improve the removal of water ice from refrigeration systems and in particular to make it possible to remove water ice without any interruption in operation of the refrigeration system.

[0010] From the process standpoint, this object is solved by the fact that the water ice is removed by suction from the interior of the refrigeration system using a blower and at least one suction connection. Preferably at least three suction connections are used.

[0011] DETAILED DESCRIPTION

[0012] In one embodiment of the present invention, ~~It~~ it is especially preferable for the water ice to be vented with the help of suction connections from a conveyor belt on which the refrigerated goods are conveyed through the refrigeration system. The mobility of the conveyor belt is advantageously ensured by the suction removal

of water ice deposited there. Thus the blockage in movement of the conveyor belt caused by the water ice can be prevented.

[0013] According to a particularly advantageous embodiment of this invention, the suction connections are in movement during the suction, in particular being pivoted. Therefore, it is especially advantageous that the effect of the suction can also be made accessible for the entire conveyor belt and/or for the entire interior of the refrigeration system with the same quality everywhere, even when working with a low number of suction connections.

[0014] With regard to the device, this object is achieved by the fact that at least one suction connection for water ice is provided in the interior of the refrigeration system being operatively connected to a suction blower. Preferably at least three suction connections for water ice are provided.

[0015] The suction connections are especially preferably mounted in the refrigeration system in such a way that the water ice is removed by suction from a conveyor belt on which the refrigerated goods are conveyed through the refrigeration system.

[0016] According to a particularly advantageous embodiment of this invention, the suction connections are movably mounted, in particular pivotably mounted in the interior of the refrigeration system.

[0017] The water ice is advantageously removed without interrupting the operation of the refrigeration system. Another advantage is that in contrast with the traditional method of blowing out the water ice by certain components, no medium is introduced into the refrigeration system. This reliably prevents the risk of additional soiling or additional moisture being introduced into the refrigeration system in the removal of the water ice. The suction proceeds without contact, which also contributes to being able to meet high hygiene requirements with the present invention.

[0018] Some of the atmosphere in the refrigeration system, usually cold air optionally enriched with nitrogen or carbon dioxide, is removed by suction together with the water ice. The atmosphere functions as a transport medium (carrier substance), so to speak, for the water ice to be removed by suction. The water ice removed by suction is supplied together with the atmosphere that is also removed by suction through a pipeline or a pipeline system or through tubing, for example, and sent for disposal outside of the refrigeration system.

[0019] The foregoing disclosure has been set forth merely to illustrate the invention and is not intended to be limiting. Since modifications of the disclosed embodiments incorporating the spirit and substance of the invention may occur to persons skilled in the art, the invention should be construed to include everything within the scope of the appended claims and equivalents thereof.